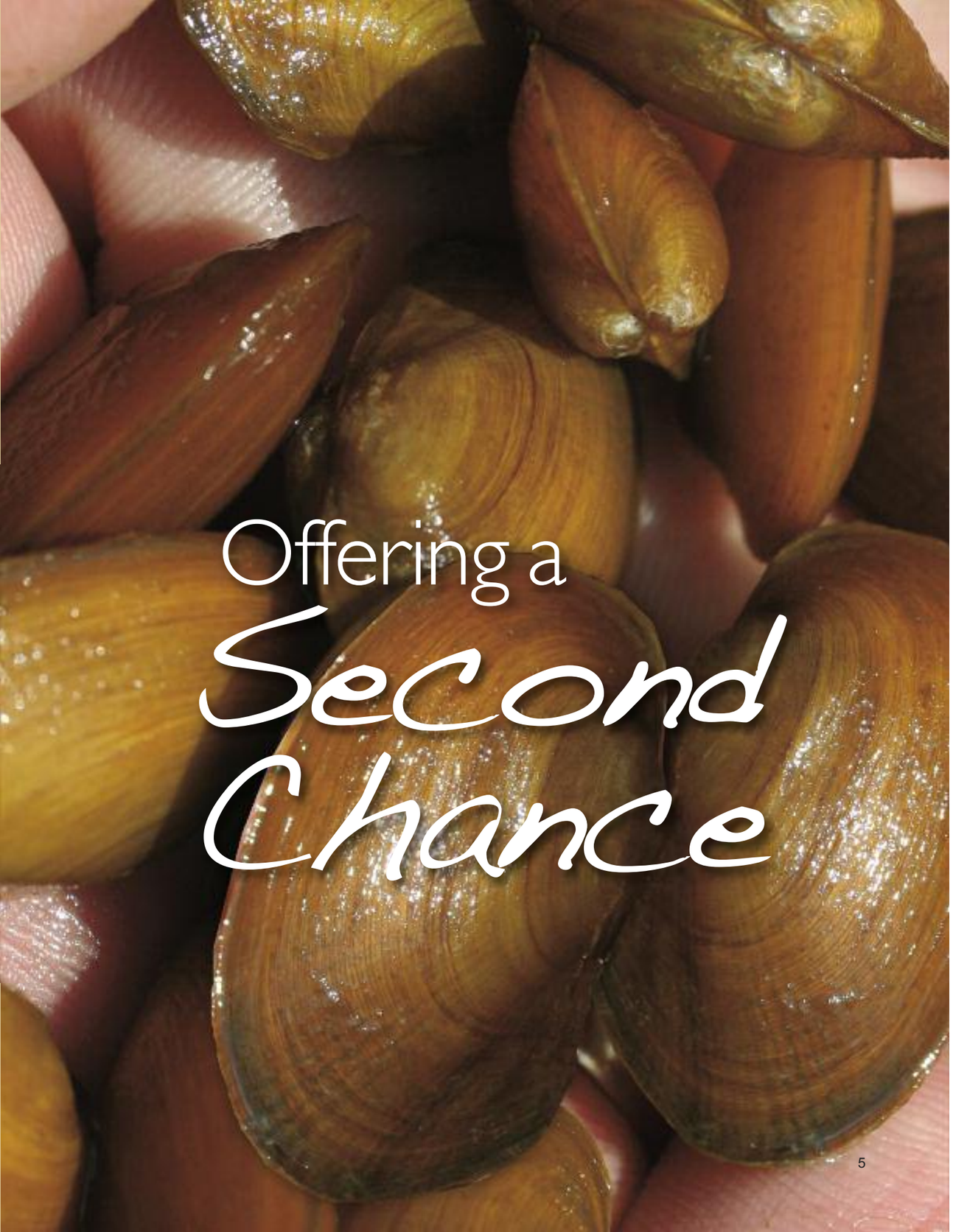
Offering a
Second
Chance

With little fanfare and a spirit of cooperation, biologists reintroduce endangered mussels to the rivers of Southwest.

by Gail Brown

Snowshoe hare? Sure. Shortnose sturgeon? Of course. Red cockaded woodpecker? Virginia big-eared bat? Green sea turtle? Yes. Yes. Absolutely! But the birdwing pearlymussel? The purple bean? Tan riffleshells? The oyster-mussel and cracking pearlymussel? What are the chances freshwater mussels, so benign and sedentary, would become the center of turmoil and controversy? Who could have predicted the value of the Tennessee heelsplitter, or estimated the loss of the Ohio pigtoe?

What happened to these beautiful creatures and to the rivers of Virginia's upper Tennessee River Basin is tragic. What is happening today to protect and restore these treasures is inspiring. And at the heart of it all remains a simple, one-footed creature that lives inside two hinged shells; an animal in possession of an incurrent and excurrent siphon capable of filtering over a gallon of water an hour; a bivalve so content it will sit for 50 to100 years in the hope that food, and for some, sex, might chance to float their way. Chancy indeed, considering all the complex events that must take place at a particular time, and in a particular order, for mussels to reproduce. Yet at one time mussels were plentiful. Lining the waterways of southwestern Virginia like cobbles on the yellow brick road, they appeared to go on forever. Not any more.

Before dams were constructed, before industrial waste spilled into the rivers, before pollution invaded our waterways, and long before the exotic zebra mussel overwhelmed native mussels like the threeridge and pink mucket, the United States was blessed with almost 300 species of healthy freshwater mussels. The significance of that number, 300, becomes apparent when considering the fact that there are only 1,000 species worldwide. In all of Africa, only 96 species exist; across all of China, only 60; and in all the countries of Europe only 12 species can be found. How amazing, then, that Virginia has 81 species, with over 45 documented in the upper reaches of the Powell, Clinch, and Holston rivers. Of those 45 species, several are found solely in Virginia. In centuries past these riverbeds must have sparkled as no other, for mussels are not only indicators of clean, healthy waterways, but serve as filters that continually clean up after other organisms, algae, and bacteria. And they can do this for decades as long as their environment is not too greatly disturbed.

But things were disturbed, horribly so, resulting in over 7 percent of the freshwater mussels in the United States becoming extinct and over 70 percent listed as at risk. Of the species remaining, 50 percent are protected by the United States Endangered Species Act. Numbers can hurt. Numbers like the 5.8 million gallons of coal waste slurry that seeped into the North Fork Powell River in 1996, settling over federally listed fish and mussels and contaminating everything for 50 miles. Or numbers like 130 million gallons of ash slurry that flowed into the Clinch River in 1967, killing over 200,000 fish and an untold number of mussels in just 4 days! Almost 90 miles of the river were impacted as the poison seeped through southwestern Virginia and on into Tennessee. While the Clinch struggled to recover, the sulfuric acid spill of 1970 slammed into its fragile ecosystem, severely impacting the river's rare and already endangered mussel population, which, since they are much slower to reproduce than other aquatic life forms, was still vulnerable when this new disaster struck.

Numbers told the tale again when, in 1998, 1,350 gallons of a rubber accelerant spilled into a tributary of the Clinch following a tanker truck accident. An estimated 18,000 mussels, including 750 endangered freshwater mussels (of three different species) as well as fish, snails, and other aquatic organisms were destroyed. It was a terrible day, one that

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Here, juveniles 15mm and larger are kept in this upweller system. A mesh screen allows ambient pond water to provide a natural food source. Below, the Clinch River.

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Birdwing pearlymussel *(Lemiox rimosus)*


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Purple bean *(Villosa perpurpurea)*

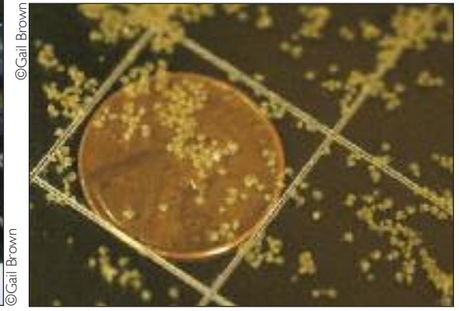
Water is constantly circulated through pans of sediment to simulate stream conditions. Temperature and food supply are controlled.

would be recorded as the date of the largest endangered species kill-off in the United States since the Endangered Species Act of 1973 came to life. The result? While the upper Tennessee drainage system of Virginia claims 102 species—over one-third of the entire fauna of freshwater mussels in the United States—Virginians can lament the fact that when the area is compared to watersheds of similar sizes, the Clinch holds an unfortunate first place for having the greatest number of at-risk fish and mussels and the Powell, the equally unfortunate third.

Yet unlike other areas where no mussels remain, these rivers still have a viable mussel population: In the end, in Virginia, both mussels and opportunity made it through. Factor in opportunity and a very different equation surfaces. Recognizing this, in 1998, with the goal of propagating and protecting the commonwealth's mussels and educating all citizens about their value, the Department established the Aquatic Wildlife Conservation Center (AWCC) within the Buller Fish Cultural Station, just outside of Marion. There, through the work of Aquatic Resource Project Manager Michael J. Pinder and biologists Amanda Duncan, Joseph Ferraro, and Jonathan Orr, the chances that some species can be replenished are steadily being realized. Because of the complexity of propagating these species even in controlled situations, however, nothing is guaranteed. While mussels have a long life span, their ability to reproduce in large numbers in the wild is now risky at best.

Under optimal conditions, the process happens as follows: The male releases sperm which float downstream to waiting females. The female mussels take in the sperm through their incurrent siphon. Anywhere from hundreds to thousands of fertilized eggs should develop into glochidia (larvae) within the gills of the mussel. Within two weeks to two months, depending on the species, the glochidia will drop into the water and attach themselves to a fish. This is a very chancy stage, as only certain fish can serve as host fish for each species of mussel for development to continue. Should the correct fish become implanted, the glochidia encyst into the tissue of the fish where they will continue to grow and develop into complete organisms. Once developed, the glochidia drop from the host fish, burrow into the substrate as juveniles, and continue to grow, hopefully to become healthy adult mussels.

While each stage of development in the wild is fraught with chance, at AWCC each step is carefully controlled and monitored. At the beginning of the process, the glochidia are collected and studied under a microscope to make sure the larvae are ready before being implanted into the right host



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All juvenile mussels must be counted.

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Duncan checks the health, survival, and growth rate of new juvenile mussels.

(L to R) Ferraro, Duncan, and Pinder were all smiles last fall when over 3,500 federally endangered mussels raised at AWCC were released into the Clinch River. Lee Walker

fish for the correct mussel species. Care is taken so that the host fish remain healthy and are not overly infested. Once juvenile mussels drop from the host fish they are removed and placed in holding tanks, and the detailed, often tedious job of counting the juveniles begins—no easy task since the animals are smaller than a grain of salt! Those same mussels must be counted again 28 days later and again and again before being released into the wild. From 2003 to 2010, over 4,101,481 freshwater mussels from 25 different species were raised. During that same time period, 675,462 mussels of 20 different species were released into the Clinch and Powell rivers. That's a lot of counting and a lot of transplanting!

Very impressive. But how is it possible? Mussel Propagation Specialist Joseph J. Ferraro believes he knows the answer. He says it's the staff's ability to get along and work together that has made the difference. Ferraro includes the staff at Buller Fish Station in this assessment as well. "They work closely with us to help us. I can tell you that's not always the case in other centers. But that's what people do in this area—they help their neighbors out." That's true. It's also true that through hard times, long days, and cold nights, neither those tough mussels nor those determined biologists thought to cry "uncle." No doubt typical of the area as well.

Pinder, who has been at the center since it opened, recalls, "When we first began, we struggled to produce even a few mussels that were large enough to release. Times have changed. In September of 2010 we released 3,500 federally endangered mussels representing two different species we raised here at the center. It was the biggest single release of larger sized, endangered freshwater mussels in the eastern United States." Virginia can be proud of that effort. We can all take comfort in those numbers.

Still, there is more work to do as increasing the number of mussels restored to our rivers is only part of the equation. Educating others about the history and value of freshwater mussels is of equal importance if these animals are to have a fighting chance to make a comeback. "Education is an important part of our job," states AWCC biologist Amanda Duncan. "We continually host school groups, from elementary to college level, and attend community outreach programs, such as Kids in the Creek Days, watershed festivals, and numerous outdoor events to help get the word out. We have people visiting the area as well as residents who stop by, and we always take the opportunity to educate them before they leave. They always have questions." One answer was easy: "No, they are not for eating!"

Because of the diligence of people like Pinder, Duncan, Ferraro, and Orr, there is a good chance things could turn around and we might keep these natural treasures we are so fortunate to have. No one expects to see the numbers we had centuries ago, but certainly we can move forward from where we were decades ago. So for now, the team continues to go about their work and watch the numbers. In time, their diligence and patience may earn us something we don't often get: a second chance. A lot can change, given a second chance.

Gail Brown is a retired teacher and school administrator.